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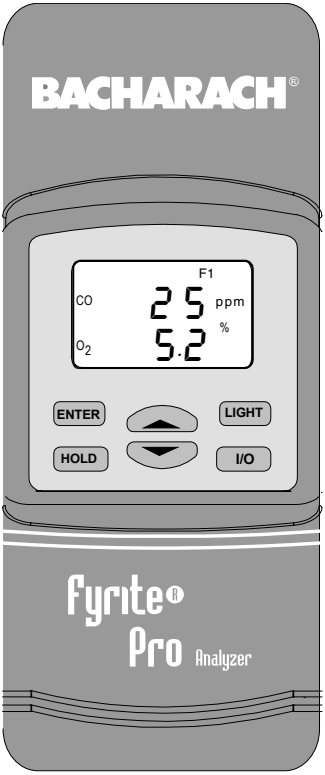
# Fyrite® Pro
## Combustion Gas Analyzer

### Instruction 24-9395
### Operation & Maintenance
**Rev. 9 – July 2004**

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# Ordering Information

| Model | 100 | 100 Printer Kit | 105 | 110 | 120 | 125 | 125 Printer Kit | 125 Printer/ Oil Kit |
|---|---|---|---|---|---|---|---|---|
| **Part Number** | 24-8200 | 24-8201 | 24-8202 | 24-8103 | 24-8104 | 24-8105 | 24-8205 | 24-8206 |
| **Measurements** | | | | | | | | |
| Oxygen | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Stack Temperature | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ambient Temperature | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Second Thermocouple Channel (Combustion Air Temperature) | | | | | | ✓ | ✓ | ✓ |
| Differential Temperature | | | | | | ✓ | ✓ | ✓ |
| Carbon Monoxide (CO) | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Draft | | | ✓ | | | ✓ | ✓ | ✓ |
| Differential Pressure* | | | ✓ | | | ✓ | ✓ | ✓ |
| **Calculations** | | | | | | | | |
| Combustion Efficiency | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Excess Air | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Carbon Dioxide ($CO_2$) | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO (Air Free) | | | | | ✓ | ✓ | ✓ | ✓ |
| **Supplied Accessories** | | | | | | | | |
| Probe & Hose Assembly | 19-7110 | 19-7110 | 24-3004 | 19-7111 | 19-7111 | 24-3004 | 24-3004 | 24-3004 |
| Carrying Case (24-0865) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Rubber Boot (24-1127) | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tygon Tubing (03-6109) | | | ✓ | | | ✓ | ✓ | ✓ |
| Barb Fitting (03-5251) | | | ✓ | | | ✓ | ✓ | ✓ |
| Printer (24-1229) | | ✓ | | | | | ✓ | ✓ |
| Smoke Test Kit (21-7006) | | | | | | | | ✓ |
| | | | | | | | | |

* To measure differential pressure, use optional Pressure Kit 24-8214

## Notes:

# 1.0 INTRODUCTION

## 1.1 The Fyrite Pro

The Fyrite Pro series of instruments are hand-held analyzers that are designed for on-demand sampling of residential furnaces and appliances. The more advanced models can also to used to check combustion efficiency by measuring the stack temperature and the percent oxygen level in the flue-gas stream.

The Fyrite Pro is completely upgradeable from the very simple Model 100 that measures only carbon monoxide, to the Model 125 that measures carbon monoxide (CO), oxygen ($O_2$), draft, differential pressure, ambient air temperature, stack temperature, and combustion air temperature, as well as calculating combustion efficiency, excess air, carbon dioxide ($CO_2$), differential temperature, and CO air free.

This manual contains information on all models of the Fyrite Pro. Please disregard any information that does not pertain to your model.

**⚠ WARNINGS!**

*This analyzer is not intended to be used on a continuous basis.*

*This analyzer does not have an audible alarm, and is not intended to be used as a safety device.*

*Except for battery replacement, this analyzer should only be opened and serviced by authorized personnel.*

*When testing an appliance, a full visual inspection of the appliance should be carried out to ensure its safe operation.*

# 1.2 Operational Overview

Pressing the **I/O** button turns the analyzer ON. Note that there is a warm-up period of either 10 or 60 seconds, dependent on the analyzer's model and setup, that must elapse before the analyzer can be used.

When using the analyzer to just measure CO or draft, insert the analyzer's probe into the flue-gas stream of the appliance under test and begin testing. The measured values of draft and/or CO will appear on the analyzer's LCD.

For models that calculate combustion efficiency, choose a fuel code that corresponds to the fuel being burned by the appliance being tested, and then press the **ENTER** button to place the analyzer into its Run Mode. Begin testing by inserting the analyzer's probe tube into the flue-gas stream of the appliance under test. The analyzer will monitor the flue gas and display measured and calculated values that are relative to the combustion process. These values are displayed on the analyzer's LCD, and are chosen for display by pressing the Increment **(▲)** and Decrement **(▼)** buttons.

Pressing the **HOLD** button during a test will freeze all measured and calculated values at their current levels. Pressing the **ENTER** button resumes testing.

For analyzers with memory, pressing the **HOLD** button *twice* during a test will display the Print/Memory Menu Screen. Using the **▲▼** and **ENTER** buttons the operator can choose to print the current readings, save the current readings in memory, recall and view saved readings from memory, clear all the memory, or print all saved readings.

A backlight enables an operator to read the display in dimly-lit areas. Pressing the **LIGHT** button turns the backlight ON and OFF. The backlight will automatically turn OFF after 10 minutes of keyboard inactivity.

A power saver function will shut the analyzer OFF after 20 minutes of keyboard inactivity. For models with an $O_2$ and CO sensor, however, the power saver function is disabled if the detected $O_2$ value is less than 17.9% or the CO value is more than 50 ppm.

Press the **I/O** button to turn the analyzer OFF. Note that there is a 5 second delay before the analyzer actually turns OFF, during which time the unit can be kept ON by pressing the **ENTER** button. For analyzers that contain a CO sensor, there is a CO purge feature that keeps the analyzer's pump running until the measured CO level drops below 50 ppm.

# 2.0 TECHNICAL CHARACTERISTICS

**The Analyzer Directly Measures and Displays:**

- Ambient Temperature ..... 32 to 212 °F (0 to 100 °C)
- Flue Gas $O_2$ content..... 0.0 to 20.9% $O_2$
- Flue Gas Temperature ..... 0 to 999 °F (–18 to 537 °C)
- Flue Gas CO content ..... 0 to 2,000 ppm CO
- Draft..... –9.99 to 27 inWC (–9.99 to 67 mb/HPa)

**The Analyzer Computes and Displays:**
(when the measured oxygen level is below 17.9%)

- Combustion Efficiency..... 0.1 to 99.9%
- Flue Gas $CO_2$ content..... 0.1 to a fuel dependent maximum value in %
- Flue Gas CO Air-Free content..... 0 to 9,999 ppm
- Excess Air..... 0 to 400%

**Fuel Selection:**
(F1 thru F4 denotes the fuel selected as displayed on the LCD)

- Natural Gas (F1)
- Oil #2 (F2)
- LPG (F3)
- Kerosene (F4)

**Normal Operating Conditions:**

Temperature:
- Analyzer ..... 32 to 104 °F (0 to 40 °C)
- Probe..... 1,000 °F max (538 °C) at 5" insertion

Humidity..... 15 to 90% RH, Non-Condensing

Power Requirements ..... Four disposable 'AA' Alkaline batteries (an optional AC adapter is available that eliminates the need for batteries)

**Operating Time** ..... Up to 18 hours continuous (pump running and backlight off)

**Warm Up Time** ..... 10 or 60 seconds, dependent on analyzer's model and setup (Refer to Section 4.13.1)

**Memory (Model 105/110/120/125)**..... Up to 10 sets of readings can be saved in memory. When memory is full, the next reading saved will overwrite the oldest reading.

**Display** ..... 4 Digit, 2 Line, 7-segment Liquid Crystal Display

**Front Panel Controls** ..... Six push button switches (Refer to Section 3.4)

**Accuracy:**

- Oxygen..... ±0.3% $O_2$ with a typical flue gas concentration of $CO_2$
- Carbon Monoxide ..... ±5% of reading or ±10 ppm, whichever is greater*
- Flue Gas Temperature..... ±4 °F between 32 & 255 °F (±2 °C between 0 & 124 °C)
  ±6 °F between 256 & 480 °F (±3 °C between 125 & 249 °C)
  ±8 °F between 481 & 752 °F (±4 °C between 250 & 400 °C)
- Second Thermocouple Channel ..... ±4 °F between 32 & 212 °F (±2 °C between 0 & 100 °C)
- Ambient Temperature..... ±4 °F between 32 & 104 °F (±2 °C between 0 & 40 °C)
- Draft..... ±1% of reading or ±0.02 inWC (±0.05 mB), whichever is greater

* Tighter CO accuracy in the lower ranges, up to ±2 ppm, may be attained if a lower range calibration gas (e.g. 100 ppm CO) is used.

# 3.0 SETTING UP THE ANALYZER

## 3.1 Preliminary Steps

Before using the analyzer . . .

- Check batteries (Section 3.2)
- Connect probe to analyzer (Section 3.3)
- Check setup (Section 3.5)

## 3.2 Checking & Replacing the Batteries

Install fresh batteries as described below. Check the analyzer for sufficient charge prior to each use. Replace the batteries if the low-battery symbol appears in the lower right corner of the screen. To replace the batteries:

1. Remove battery cover from back of analyzer.
2. If old batteries are installed, remove them and properly discard.
3. Observing the polarity markings inside the battery compartment, install four 'AA' Alkaline batteries as shown in Figure 3-1.
4. Replace battery cover.

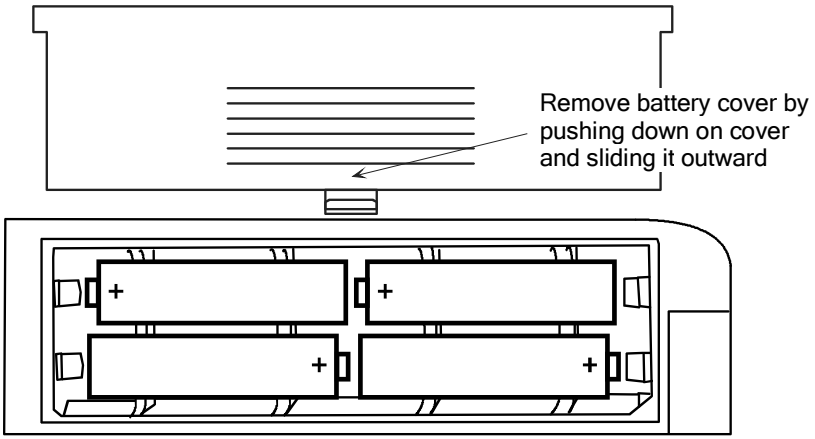



***Figure 3-1. Battery Installation***

## 3.3 Connecting the Probe Hose and Thermocouple

The analyzer's model number determines which hose and thermocouple connections are made at the bottom of the unit. Perform the following steps as required by your particular analyzer model (see Figures 3-2A thru D):

1. Push the probe's sample-gas hose onto the GAS inlet fitting.
2. Push the probe's draft hose onto the "+" pressure fitting.
3. Push the probe's thermocouple into the T-STACK jack

   **Important:** *DO NOT force the thermocouple connector into its jack. The connection tabs are different sizes, allowing the connector to fit in only one way.*

4. Push the optional room-air/primary-air thermocouple into the T-AIR jack.

Inspect the flue-gas hose for cracks. If a hose is defective, replace the entire probe assembly.

Before using the analyzer, check that the Water Trap / Filter is dry and not dirty. If necessary, dry out the trap and replace the filter element per Section 5.8.

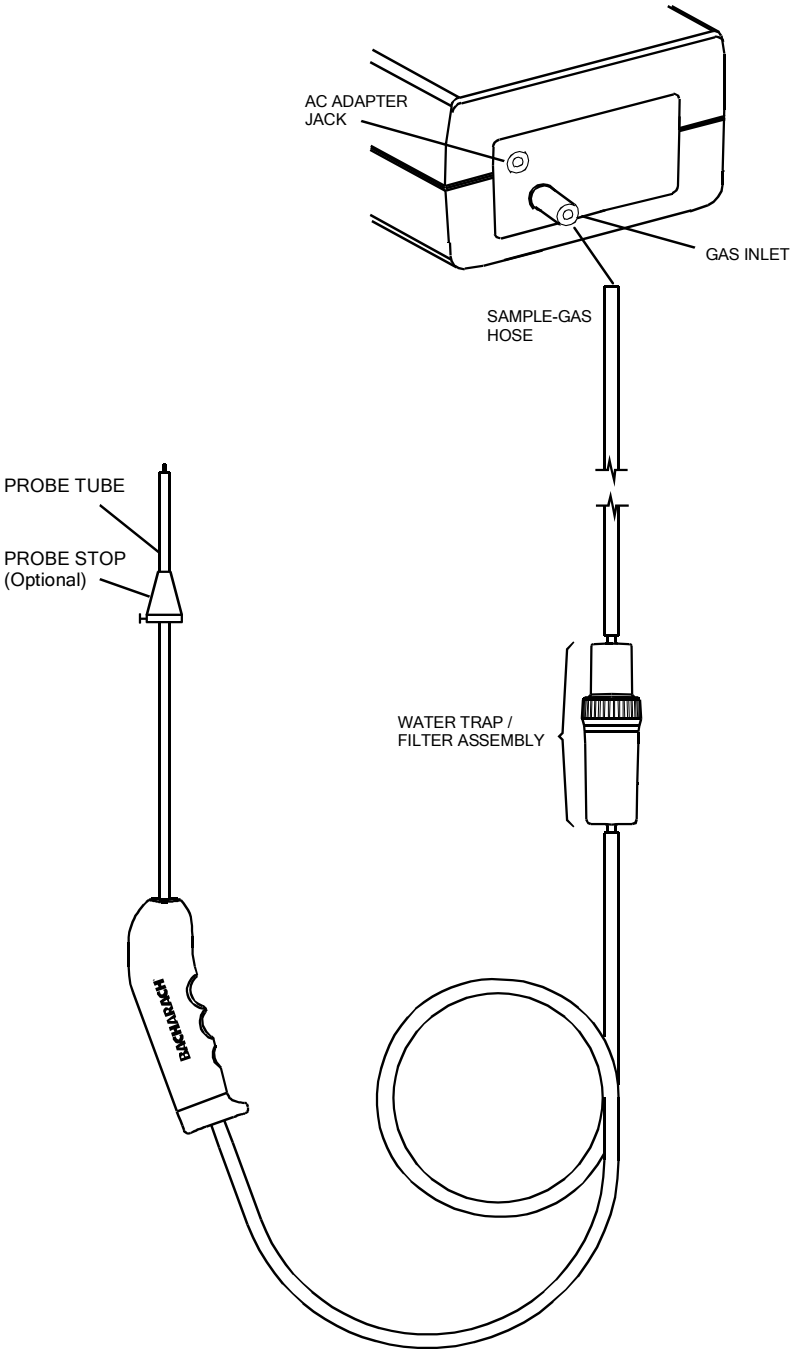



***Figure 3-2A. Connecting the 19-7110 Probe (Model 100)***

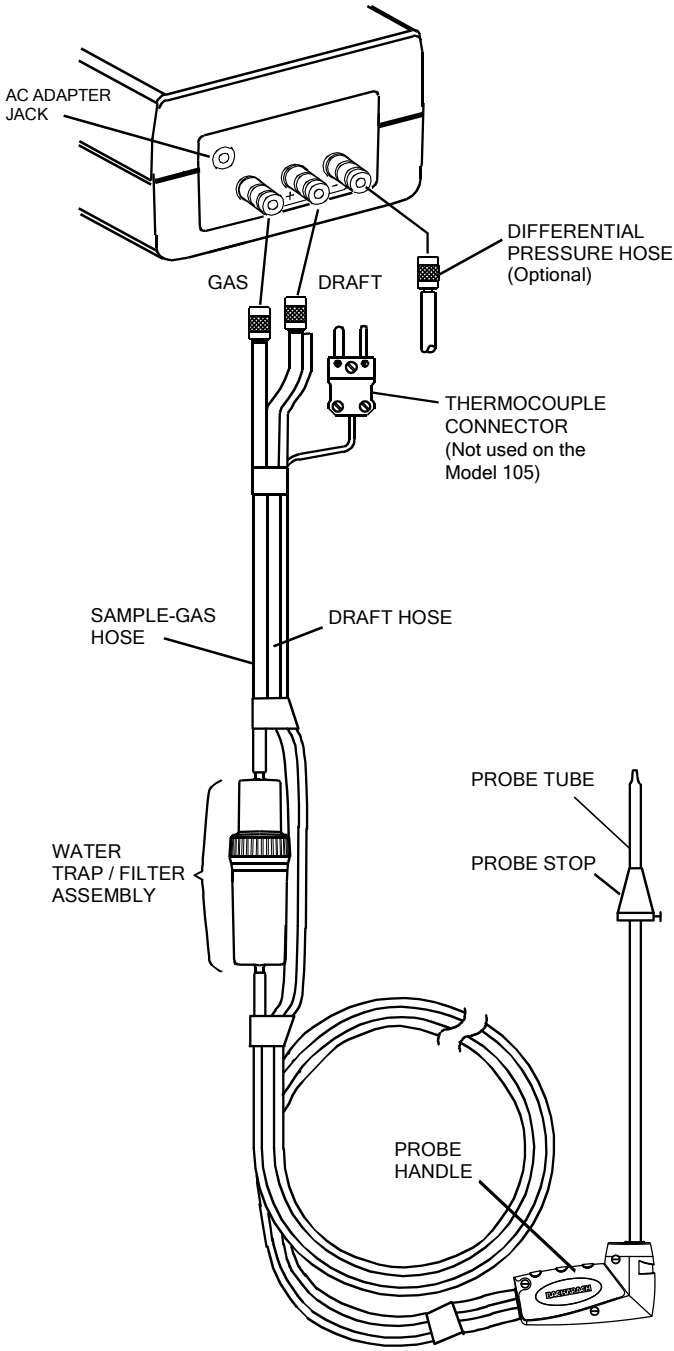



***Figure 3-2B. Connecting the 24-3004 Probe (Model 105)***

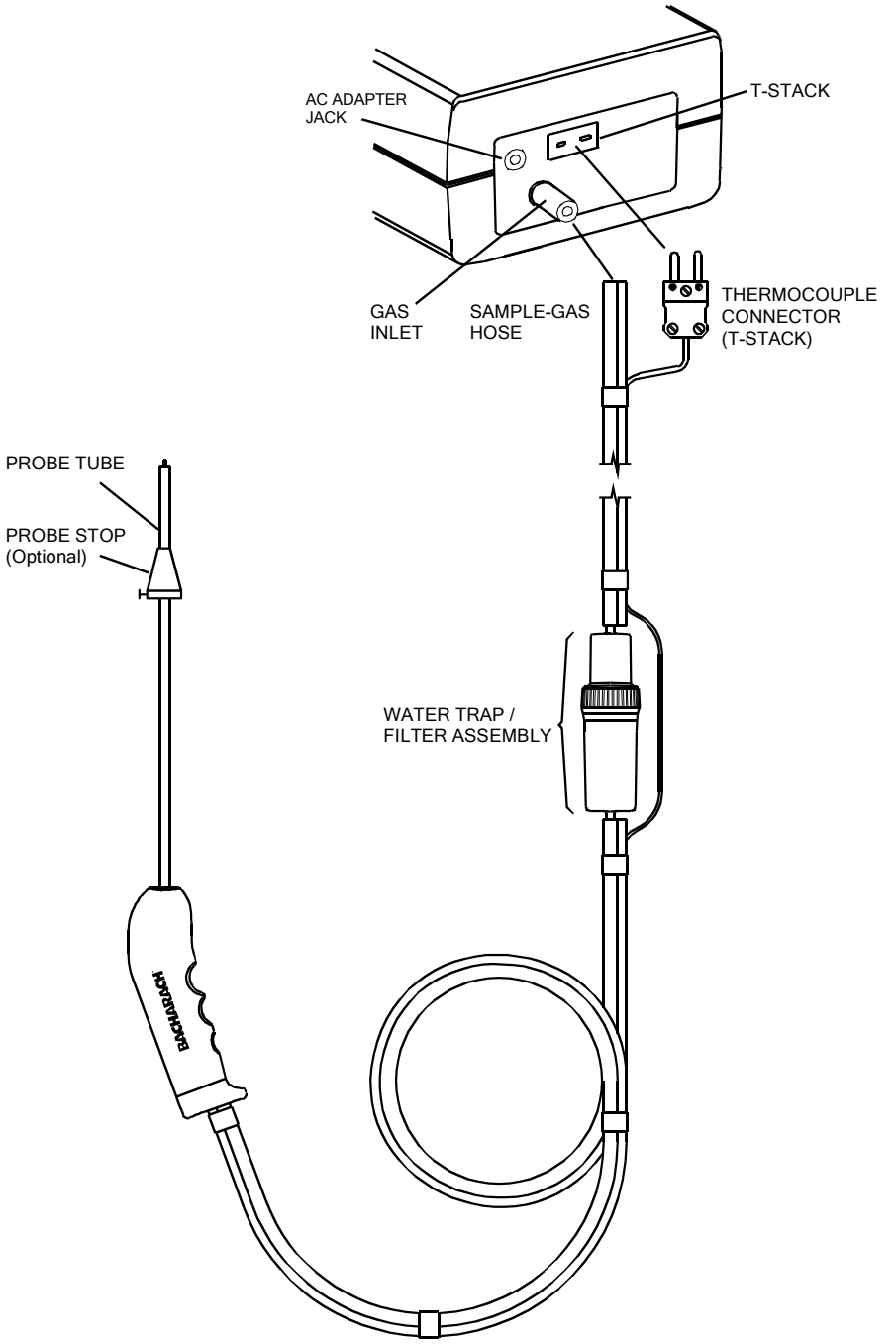



***Figure 3-2C. Connecting the 19-7111 Probe (Model 110/120)***

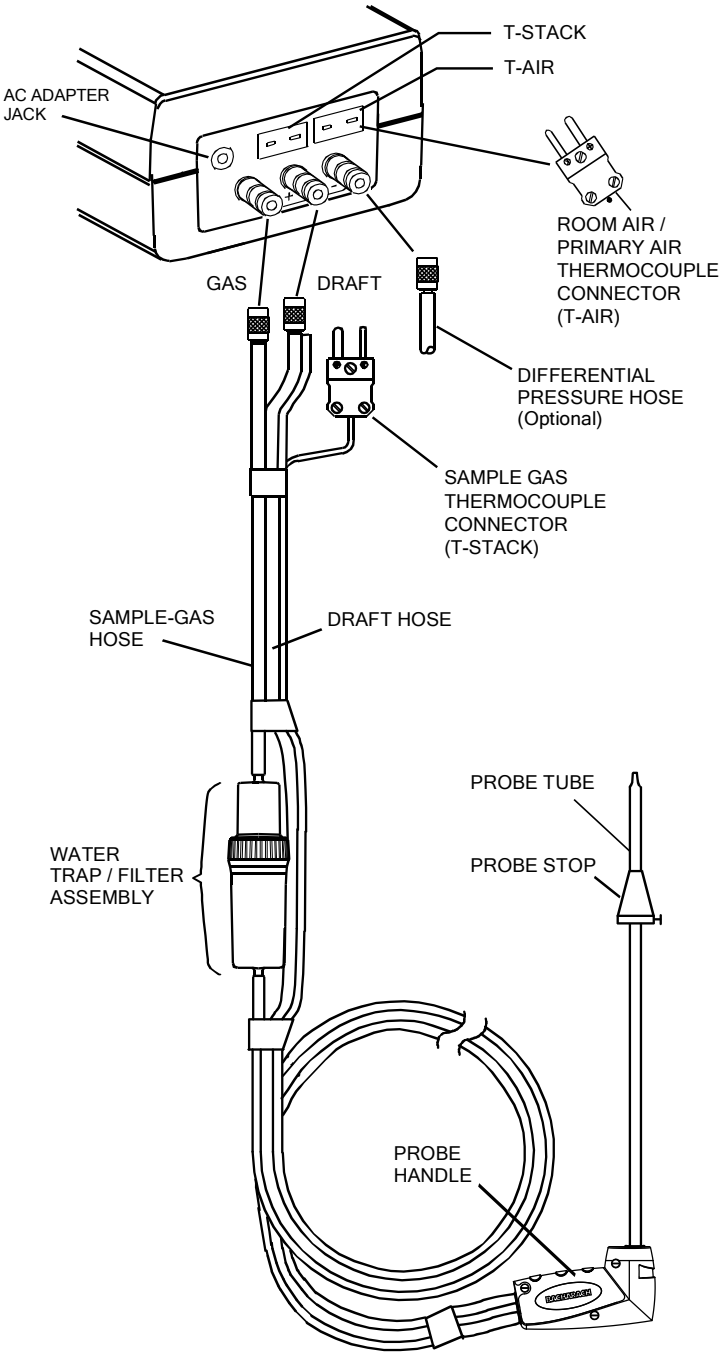



***Figure 3-2D. Connecting the 24-3004 Probe (Model 125)***

# 3.4 Front Panel Push Buttons

Note that a push button may perform several functions, depending on the analyzer's model number and what screen is being displayed at the time.

**I/O**
- Toggles the analyzer ON and OFF.
- Places the analyzer into either its Setup or Calibration Mode when used in conjunction with the **ENTER** or **HOLD** button.

▲
- Scrolls up through the display screens during a test.
- Causes the displayed value to increase or change while in the Calibration, Setup, or Print/Memory Menu Screen.

▼
- Scrolls down through the display screens during a test.
- Causes the displayed value to decrease or change while in the Calibration, Setup, or Print/Memory Menu Screen.

**ENTER**
- Enters the Run Mode (starts a combustion test) from the Fuel Select Screen.
- Unfreezes the display after pressing the **HOLD** button.
- Displays the Fuel Select Screen when held down for 2 seconds while in the Run Mode.
- Performs the action selected in the Print/Memory Menu Screen.
- Stores the displayed value and automatically steps to the next screen when pressed during calibration or setup.
- Places the unit into its Run Mode when held down for 2 seconds while in the Calibration Mode.
- Aborts turn-off and keeps the analyzer turned ON when pressed during the 5 second turn-off-delay period.
- Aborts the CO purge function at turn-off when the measured CO level is above 50 ppm.
- Sets up the analyzer to be placed into its Calibration Mode when held down with the analyzer OFF. (Used in conjunction with the **I/O** button.)

**HOLD**
- Places the analyzer on hold and freezes the values in all Run Mode Screens during a test, allowing the operator to scroll through the displays and view all test values at that point in time. Pressing **ENTER** resumes testing.
- Model 100: Starts a printout when pressed *twice* from the Run Mode.
- Model 105/110/120/125: Displays the Print/Memory Menu Screen when pressed *twice* from the Run Mode.
- Sets up the analyzer to be placed into its Setup Mode when held down with the analyzer OFF. (Used in conjunction with the **I/O** button.)

**LIGHT** Toggles the backlight ON and OFF.

# 3.5 Setup Mode

The analyzer is preset at the factory for the parameters shown below, but can be changed as described in their associated sections.

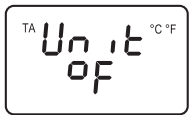
| Function | Parameter | To Change |
|---|---|---|
| Fuel | Natural Gas (F1) | Section 4.13.5 |
| Temperature Unit | °F | Section 3.5.2 |
| CO Channel | Auto Zero (A2) | Section 3.5.3 |
| Draft (Pressure) | WC | Section 3.5.4 |
| Clock | Not Initialized | Section 3.5.5 thru 3.5.7 |
| Printer Protocol | IrDA | Section 3.5.8 |

## *3.5.1 Entering Setup*

1. With the analyzer turned OFF, press and hold down the **HOLD** button.
2. Press the **I/O** button.
3. Release both buttons.
4. The analyzer is now in its Setup Mode. Refer to Sections 3.5.2 thru 3.5.8 for information on how to set up each analyzer parameter.

## *3.5.2 Selecting Temperature Units*

The Temperature Setup Screen is labeled “Unit.”




1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press the **ENTER** button until “Unit” is displayed.
2. Press the ▲ or ▼ button until the desired temperature unit (°F or °C) is displayed.
3. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.3 CO Channel Setup*

The CO Channel Setup Screen is labeled “CO.”

1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press the **ENTER** button until “CO” is displayed.

2. Press the ▲ or ▼ button until the desired parameter is displayed.
   - no Sensor disabled. Use this function to turn off the CO channel if the sensor is missing or known to be bad to avoid inaccurate CO readings from appearing.
   - 2Ero Manual Zero. When the CO channel is set to manual zero, the analyzer does not zero the CO sensor to ambient conditions during start up.
   - A2 Auto Zero. With the CO channel set to auto zero, the CO sensor is zeroed to the ambient CO level during start up. **Important:** ***When using this mode the analyzer must be turned ON in fresh air; otherwise, incorrect CO readings will occur.***

3. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.4 Draft Channel Setup*

The Draft Setup Screen is labeled “PrES Unit”.

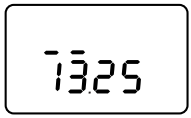
1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press the **ENTER** button until “PrES” is displayed.

2. Press the ▲ or ▼ button until the desired parameter is displayed.
   - no Pressure sensor disabled or not installed.
   - WC inches of Water Column
   - mB Millibars
   - HPa Hecto Pascals

3. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.5 Time Setup*

There are two Time Setup Screens, one for hours and the other for minutes. Two bars appear above the segments being changed. The clock is in a 24 hour format, but will appear as AM/PM on the printout.




1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press **ENTER** until the first Time Setup Screen is displayed—the one with two bars over the hour digits.
2. Press the ▲ or ▼ button until the correct hour value is displayed.
3. Press **ENTER** to move the selection bars over the minute digits.
4. Press the ▲ or ▼ button until the correct minute value is displayed.
5. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.6 Date Setup*

There are two Date Setup Screens, each labeled “DAtE”. The first screen sets the month while the second sets the day.

1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press **ENTER** until the first Date Setup Screen is displayed.
2. Press the ▲ or ▼ button until the correct month is displayed.
3. Press **ENTER** to change the ‘Day’ value.
4. Press the ▲ or ▼ key until the correct day is displayed.
5. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.7 Year Setup*

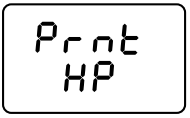
The Year Setup Screen is labeled “YEAr”.

1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press **ENTER** until the Year Setup Screen is displayed.
2. Press the ▲ or ▼ button until the correct year is displayed.
3. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.8 Selecting Printer Protocol*

The analyzer can be set up for either an HP or IrDA type printer.

1. Enter the Setup Mode per Section 3.5.1. If necessary, repeatedly press **ENTER** until one of the following screens is displayed.



2. Press the ▲ or ▼ button to select the desired printer protocol.
3. Press **ENTER** to move to the next Setup Screen, or **I/O** to exit setup.

## *3.5.9 Exiting the Setup Screen*

Press the **I/O** button at any time to exit the Setup Mode and turn OFF the analyzer. Note that the last displayed parameter is automatically saved in memory.

## Notes:

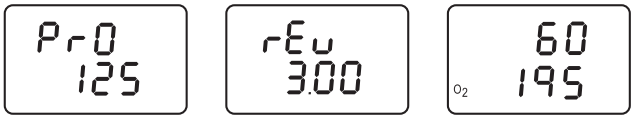
# 4.0 OPERATION

## 4.1 Performing CO and Draft Testing

### *4.1.1 Analyzer Turn On and Warm Up*

1. Connect the probe and make sure that the analyzer is properly set up per Section 3.0.

2. Turn ON the analyzer in fresh air by pressing is **I/O** button and observe that the following Warm-Up Screens are displayed.

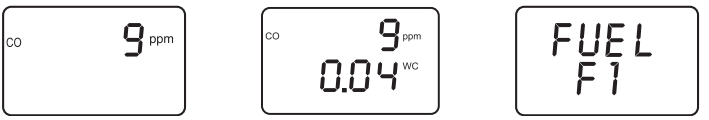



These screens show the analyzer's model number, the unit's software revision, and finally the remaining warm-up time. If an $O_2$ sensor is installed, then its current output level is also displayed.

**Note:** *The warm-up time is 10 seconds for analyzers that do not contain an oxygen sensor, and have their CO channel set up for manual zero. The warm-up time is 60 seconds for analyzers that contain an oxygen sensor, and/or have their CO channel set up for auto zero.*

**Tip:** *An $O_2$ error will occur when the oxygen sensor's output drops to between 80 and 90. Consider replacing the oxygen sensor when its output level drops below 100.*

3. Wait for the analyzer to count down its warm-up period; after which, either the CO Screen (Model 100), the CO & Draft Screen (Model 105), or the Fuel Screen (Model 110/120/125) is displayed.




Model 100 Model 105 Model 110/120/125

If, however, any errors were detected during warm-up, the Sensor Status Screen is displayed. If this occurs, refer to Section 4.13.13 for information on how to correct the error.

## 4.1.2 Measuring CO *(Model 100/105/120/125)*

1. Turn ON the analyzer and allow it to warm-up per Section 4.1.1.

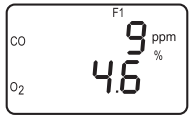
   **Important:** *If the CO channel is set up for auto zero, then the analyzer **must be turned ON in fresh air**; otherwise, incorrect CO readings will occur. Refer to Section 3.5.3.*

   *When the CO channel is set up for manual zero, and if the CO reading is higher than zero when sampling fresh air, then manually zero the CO channel per Section 5.6, Steps 1 thru 4.*

2. For the Model 100/105, the CO Screen should already be displayed. For the Model 120/125, push **ENTER** until the CO & $O_2$ Screen appears.

Model 100

Model 105



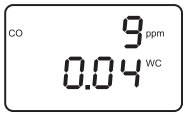
Model 120/125

3. Insert the analyzer's probe into the area to be tested and observe the detected CO level on the LCD.

## 4.1.3 Measuring Draft *(Model 105/125)*

1. Turn ON the analyzer and allow it to warm-up per Section 4.1.1.

2. For the Model 105, the CO & Draft Screen should already be displayed. For the Model 125, press **ENTER** and then press the ▲ or ▼ button as necessary to display this screen.




3. The draft reading should be zero when sampling room air. If not, press the ▼ button *once* to display the Draft Zero Screen, and then press the **ENTER** button to zero the draft channel to ambient atmospheric conditions.

4. Insert the analyzer's probe into the area to be tested and observe the draft reading on the LCD.

# 4.2 Performing a Combustion Test using the Model 110/120/125

## 4.2.1 Analyzer Turn On and Warm Up

**Important:** *The probe must be at room temperature before performing the following steps.*

1. Connect the probe and make sure that the analyzer is properly set up per Section 3.0.

2. Perform one of the following:
   - ***Model 110/120*** – Before turning ON the analyzer, its probe must be located in the area containing the burner's combustion-air supply. If the burner is using room air, simply place the probe within the room. In the case of a high-efficiency furnace where combustion air is drawn in from an outside source, insert the probe into the combustion-air stream so it can measure its temperature with the burner operating.
   - ***Model 125*** – This analyzer has a second thermocouple channel that can be used to independently monitor the temperature of the burner's combustion-air supply. When using this second thermocouple channel, insert the thermocouple into the burner's combustion-air stream, and position the probe to measure the ambient room temperature. If the second thermocouple channel is *not used*, then use the probe's thermocouple to measure the combustion-air temperature as described above for the Model 110/120.

3. Turn ON the analyzer and allow it to warm-up per Section 4.1.1.

## 4.2.2 Selecting a Fuel

1. With Fuel Screen displayed, use the ▲ or ▼ button to step through the fuels codes until the proper fuel is selected. The analyzer defaults to the most recently selected fuel.

   F1 = Natural Gas
   F2 = Oil #2
   F3 = LPG
   F4 = Kerosene

2. Press the **ENTER** button to select the displayed fuel code and enter the Run Mode.

## *4.2.3 Sampling Point*

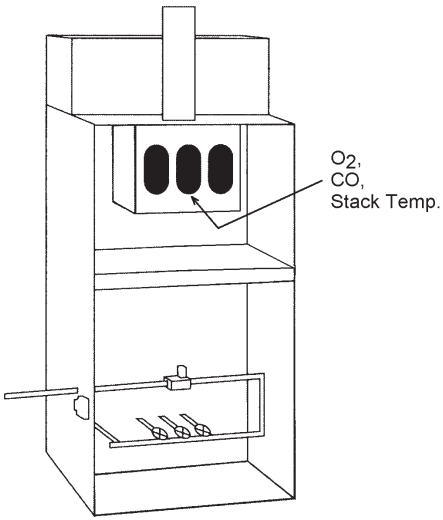
**Forced Air Furnace** – When testing atmospheric burner or gravity vented, forced air heating equipment with a clamshell or sectional heat exchanger design, test each of the exhaust ports at the top of the heat exchanger. The probe should be inserted back into each of the exhaust ports to obtain a flue gas sample, before any dilution air is mixed in.

**Hot Water Tank** – Domestic hot water tanks with the 'bell' shaped draft diverter on top can be accurately tested by inserting the probe tip directly into the top of the fire tube below the diverter.

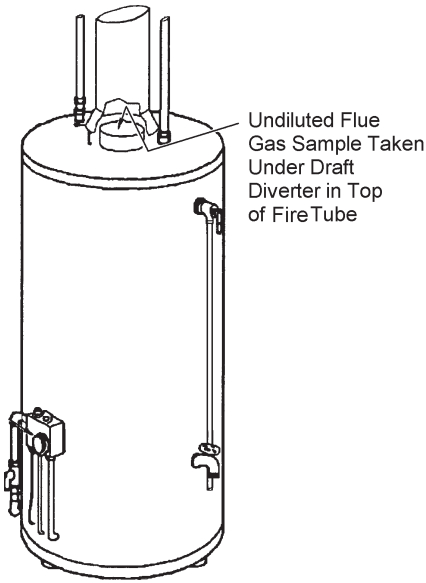
**80% Efficiency Fan Assist or Power Vented** – Combustion testing of fan assist or power vented, furnaces/boilers should be done through a hole drilled in the vent immediately above the inducer fan.

**90% Efficiency Condensing** – Condensing furnaces/boilers can be tested through a hole drilled in the plastic vent pipe (when allowed by the manufacturer or local authority of jurisdiction) or taken from the exhaust termination.

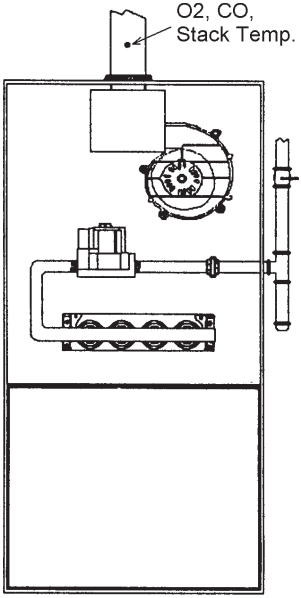
**Atmospheric or Gravity Vented Boiler** – Boilers, which have a 'bell' shaped draft diverter directly on top, should be tested directly below the diverter through a hole drilled in the vent connector.



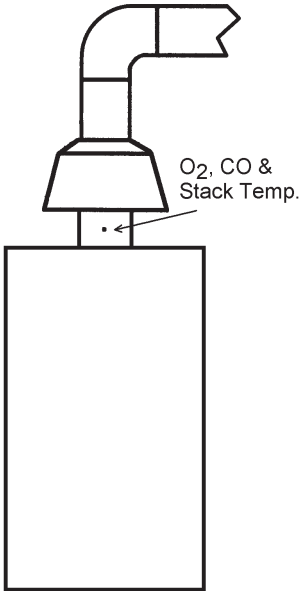

**Atmospheric Burner or Gravity Vented Forced Air**



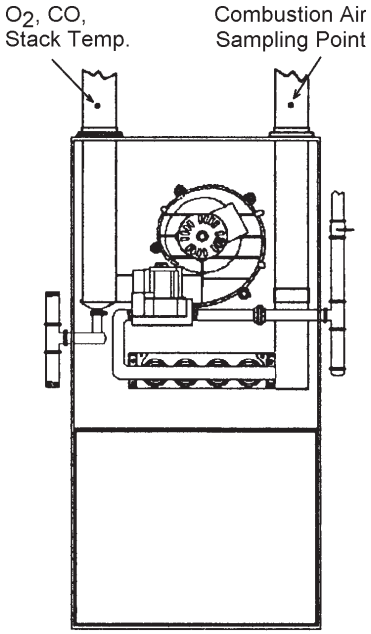

**Hot Water Tank**




**80% Eff. Fan Assist or Power Vented Furnace/Boiler**



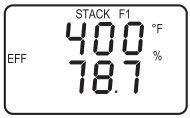

**Atmospheric or Gravity Vented Boiler**




**90% Eff. Condensing Furnace/Boiler**

## 4.2.4 Performing a Combustion Efficiency Test

1. After turning ON the analyzer and selecting the appropriate fuel, press the ▲ or ▼ button to display the Stack Temperature & Efficiency Screen (refer to Section 4.13.10).




2. Position the probe in the flue-gas stream to obtain the hottest "Stack" reading. *Locating the highest stack temperature is very important for accurate efficiency calculations.*

3. Burner-service procedures can now begin. Use the ▲ and ▼ buttons to scroll through the analyzer's other display screens (refer to Section 4.12). The analyzer readings will update continuously showing changes in burner performance.

   **Note:** *When a calcuation cannot be made because of improper data (i.e., oxygen level above 17.9%), four dashes "- - - -" appear in place of the calculated value on both the screen and printout.*

   **Tip:** *Pressing the* **HOLD** *button will freeze all readings and stop the pump, allowing the operator to scroll through the Run Mode Screens and examine the readings at any single point in time. Press* **ENTER** *to restart the pump and resume testing.*

## 4.2.5 Ending a Combustion Test

**WARNING!** ***Burn Hazard.*** *Do not touch the probe after removing it from the stack. Allow the probe to cool before handling (about 5 minutes).*

1. Remove probe from the flue-gas stream.

2. Allow the pump to run until all combustion gases are flushed from the analyzer as indicated by the $O_2$ reading returning to 20.9%.

3. Turn OFF the analyzer per Section 4.10.

## 4.3 Operating Tips

- When an analyzer is brought in from a cold vehicle, let it warm up slowly to minimize condensation. Temperatures below freezing will not damage the analyzer; however, bringing a cold analyzer into a warm, humid environment may cause condensate to form inside the case.

- If the CO channel (Model 100/105/120/125) is set up for Auto Zero (refer to Section 3.5.3), ensure that the analyzer is sampling fresh air when turned ON. Pulling a flue-gas sample through the analyzer during its warm-up period will not damage the analyzer, but it will result in incorrect CO readings. Also note that a CO sensor error will occur if the detected CO level is above 50 ppm during warm-up.

- For analyzers that are used to measure flue-gas, note that flue-gas condensate is acidic and very corrosive. It is important not to allow the analyzer's internal components to become soaked in condensate for long periods of time.

- Before each use, inspect the filter element of the water-trap / filter assembly. Replace the filter if it looks dirty.

- When sampling flue-gas, keep the analyzer above the water-trap, and keep the trap in a vertical position. This will maximize the effectiveness of the trap and keep liquid condensate from being drawn directly into the analyzer.

- When liquid condensate is seen inside the water trap, empty the trap before it becomes full. Refer to Section 5.8.

- It is recommended that the analyzer be purged after taking a flue-gas measurement before turning it OFF. Once the probe is removed from the stack, disconnect the hose assembly from the bottom of the analyzer and let the pump run for 10 minutes or so to completely remove any remaining flue gases and dry any condensate from inside the sensor chamber.

- When storing the analyzer, it's a good idea to empty the water trap and leave it open to further dry it out.

- Calibrate the analyzer every 6 months to ensure its accuracy.

## 4.4 Using the Backlight

The LCD can be read in dimly-lit areas by pressing the **LIGHT** button.

The backlight automatically turns OFF after 10 minutes of keyboard inactivity, but can be turned OFF at any time by again pressing the **LIGHT** button.

## 4.5 Using the Probe

A rigid stainless steel probe with handle, connected to a flexible hose with integral water-trap / filter can be used to draw a gas sample into the analyzer from the room, grilles, diffusers, and furnace flues.

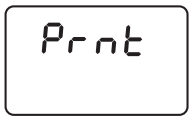
The hose and probe assembly can be detached from the analyzer when the operator desires to sample without the probe.

## 4.6 Saving Test Data in Memory
***(Model 105/110/120/125)***

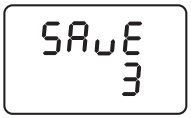
Up to 10 individual sets of test data can be saved in memory as follows:

> **Note:** *When memory is full, the next reading saved will overwrite the oldest reading.*
>
> **Note:** *The analyzer's setup information as entered in Section 3.5 is stored along with the test data. For example, temperatures stored in °C are recalled and printed in °C even if the analyzer is currently set up for °F.*

1. If the analyzer is in its Run Mode, press the **HOLD** button *twice* to enter the Print/Memory Menu Screens. If the analyzer is already in its Hold Mode, press the **HOLD** button only *once*. The first menu item displayed is the Print Screen.



2. Press the ▼ button *once* to display the Save Screen. The number shown in this screen represents the memory location (1 thru 10) to which the current test data will be saved.



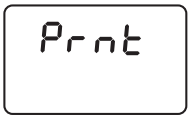

3. Press **ENTER** to save the test data and return to the Hold Mode, or press **HOLD** to return to the Hold Mode without saving.

## 4.7 Opening and Viewing Saved Test Data
***(Model 105/110/120/125)***

Perform the following to open and view saved test data:

**Note:** *If no test data has been saved, the option to open the memory for viewing will not be available.*

1. If the analyzer is in its Run Mode, press the **HOLD** button *twice* to enter the Print/Memory Menu Screens. If the analyzer is already in its Hold Mode, press the **HOLD** button only *once*. The first menu item displayed is the Print Screen.




2. Press the ▲ or ▼ button until the Open Screen is displayed, and then press **ENTER** to open the memory locations for viewing. The number shown in the second screen represents the most recent memory location where data was stored.

3. Press the ▲ or ▼ button to scroll to the desired memory location, and then press **ENTER** to recall the stored data and return to the Hold Mode. While in the Hold Mode, the recalled data can be viewed using the ▲ and ▼ buttons, or printed per Section 4.9.

# 4.8 Printing Test Data

> **Tip:** *To avoid printing errors, it is important to select the correct protocol per Section 3.5.8* ***before*** *saving data.*

Turn ON the printer. *Refer to the printer's instruction manual for detailed operation and maintenance information.*

If not already done, set the printer parameters as follows:

- Data: 8 bits
- Parity: None
- Baud: 9600
- Handshaking: X-on/X-off

Align the printer with the top of the analyzer as shown in Figure 4-1.

The next step in the printing procedure depends on the model of the analyzer, and whether the operator desires to print only the current test data, or all stored test data starting with the most recent. Perform the appropriate procedure below:

### Model 100 – Print Current Test Data

With the analyzer in its Run Mode, begin printing by pressing the **HOLD** button *twice*.

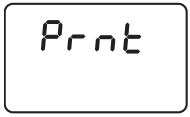
### Model 105/110/120/125 – Print Current Test Data

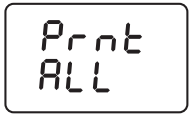
1. With the analyzer in its Run Mode, press the **HOLD** button *twice* to display the Print Screen.

2. Press **ENTER** to start printing.

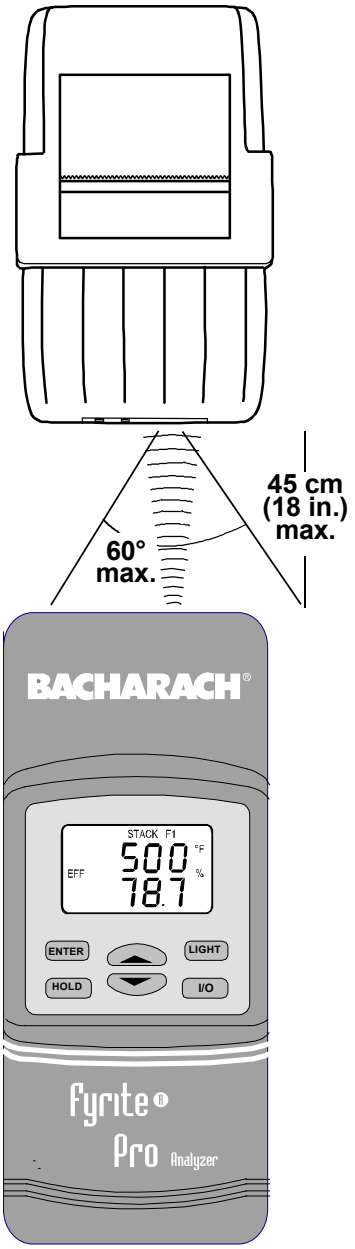
### Model 105/110/120/125 – Print All Test Data

1. With the analyzer in its Run Mode, press the **HOLD** button *twice* to display the Print Screen. Then press the ▲ button to display the Print All Screen.




2. Press **ENTER** to start printing.




```
        BACHARACH, INC.
     FYRITE PRO ANALYZER

  ========================

     DATE:   8/20/2003
     TIME:   2:45 PM

     FUEL:  (F1)Natural Gas

     EFFICIENCY     82.6 %
     EXCESS AIR     21.3 %
     STACK TEMP      374 °F
     PRIMARY TEMP   68.0 °F
     DELTA TEMP      306 °F
     O2               4.0 %
     CO2              9.5 %
     CO                12 ppm
     CO AIR FREE       15 ppm

     Draft          -0.25 WC

  COMMENTS:
```

**Notes:** When a calculation cannot be made because of improper data (i.e., oxygen level above 17.9%), four dashes "- - - -" appear in place of the calculated value on both the screen and printout.

When one or more of the following sensors are not installed, their associated values do not print:

**Oxygen Sensor:**
Fuel, Efficiency, Excess Air, Stack Temp, Primary Temp, O2, CO2, and CO Air Free

**CO Sensor:**
CO, and CO Air Free

**Draft Sensor:**
Draft

**Either Thermocouple:**
Delta Temp

***Figure 4-1. Printer Alignment & Sample Printout***

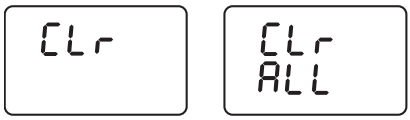
## 4.9 Clearing Saved Test Data *(Model 105/110/120/125)*

Clear all saved test data as follows:

> **Note:** *If no test data has been saved, the option to clear memory will not be available.*

1. With the analyzer in its Run Mode, press the **HOLD** button *twice* to display the Print Screen.

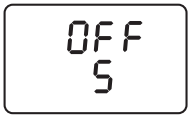
2. Press the ▲ or ▼ button to scroll to the Clear Screen, and then press **ENTER** to display the Clear All Screen.



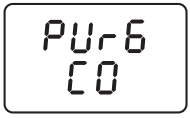

3. Press **ENTER** again to clear memory and return to the Hold Mode, or press **HOLD** to return to the Hold Mode without clearing memory.

## 4.10 Turning OFF the Analyzer & CO Purge

Press the **I/O** button to turn OFF the analyzer. The unit will count down from 5 before turning OFF, thus allowing time for the operator to abort the turn OFF process by pressing the **ENTER** button.




If a high CO level is detected at turn OFF, the unit will remain ON with its pump running and display "PUrG CO". The countdown from 5 will not begin until the detected CO level drops below 50 ppm. Although not recommended, the purging process can be bypassed by pressing the **I/O** button a second time.



## 4.11 Resetting the Microprocessor

If the analyzer 'locks up' and cannot be turned OFF, reset the microprocessor by removing one of the batteries for 5 seconds.

## 4.12 Run Mode Screens

Figures 4-2A thru 4-2E show the order in which the screens are displayed by pressing the **ENTER** and ▲▼ buttons after the analyzer warms-up and enters its Run Mode.

The top screen in each figure is the one that appears immediately after the analyzer completes its warm-up cycle.

Refer to Section 4.13 for a detailed description of each screen.

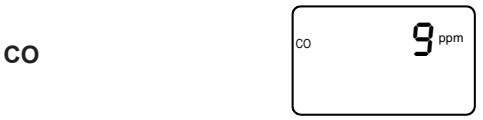



***Figure 4-2A. Model 100 Run Mode Screen***

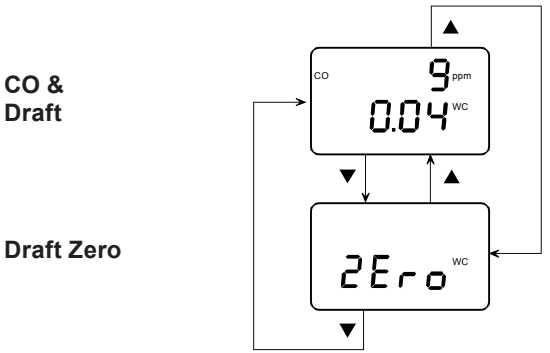



***Figure 4-2B. Model 105 Run Mode Screens***

**Fuel Select:**
F1 = Natural Gas
F2 = Oil #2
F3 = LPG
F4 = Kerosene

**$O_2$**

**Ambient / Combustion Air Temperature**

**Stack Temperature & Efficiency**

**$CO_2$ & Excess Air**

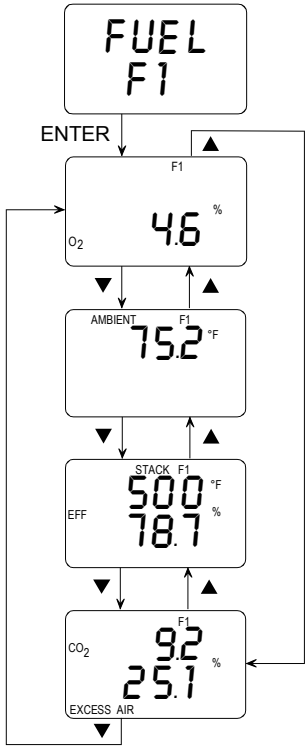



***Figure 4-2C. Model 110 Run Mode Screens***

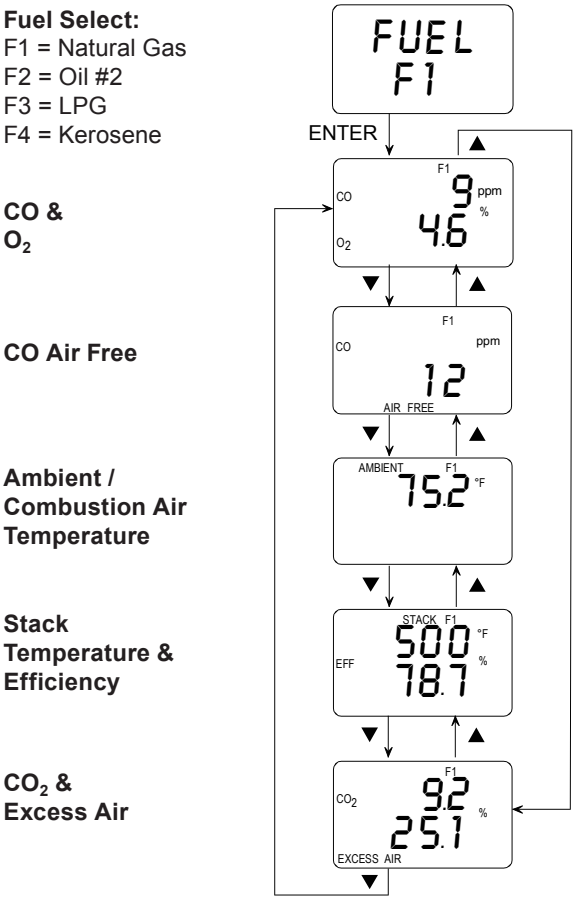



***Figure 4-2D. Model 120 Run Mode Screens***

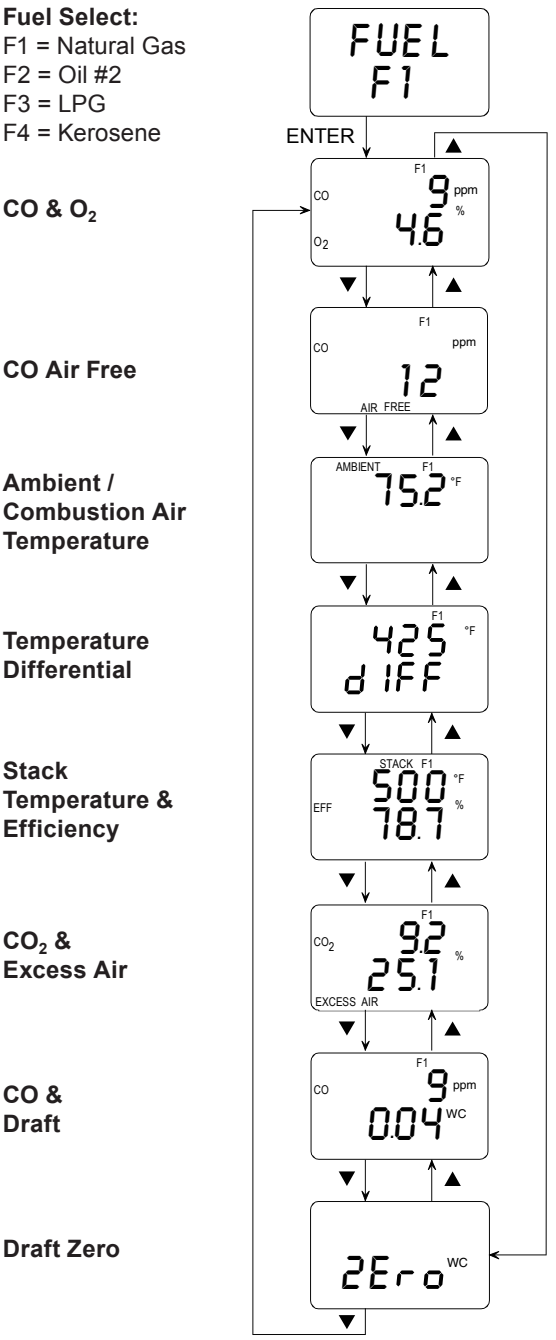
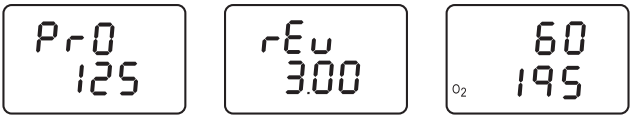



***Figure 4-2E. Model 125 Run Mode Screens***

# 4.13 Screen Descriptions

## 4.13.1 Warm-Up Screens




As soon as the analyzer is turned ON, a series of Warm-Up Screens are displayed. These screens show the analyzer's model number (Pro 100/105/110/120/125), the unit's software revision, and finally the remaining warm-up time counted down from either 10 or 60 seconds. If an $O_2$ sensor is installed, then its current output level is also displayed. The 60 second countdown only occurs when the analyzer contains an $O_2$ sensor, or if the analyzer contains a CO sensor that has been set up for auto zero (refer to Section 3.5.3). At the end of warm-up, the analyzer's first display screen appears (refer to Section 4.12).

> **Note:** *If any errors were detected during warm-up, the Sensor Error Screen (Section 4.13.13) is displayed.*

> **Tip:** *An $O_2$ error will occur when the oxygen sensor's output drops to between 80 and 90. Consider replacing the oxygen sensor when its output level drops below 100.*

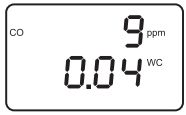
## 4.13.2 CO Screen *(Model 100)*

The CO Screen is displayed after warm-up and shows the current CO level in ppm. If the probe is being used, insert the probe tip into the area to be sampled.

**Front Panel Button Functions:**

- ▲ – No effect
- ▼ – No effect
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Restarts testing after the **HOLD** button was pressed
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.3 CO & Draft Screen (Model 105/125)*




The CO reading is a measurement of how much carbon monoxide in ppm is present in the flue-gas stream. Note, however, that the amount of CO displayed may be diluted by secondary air (refer to Section 4.13.12 CO Air Free Screen).

The draft display is the difference between the pressure at the analyzer's "+" port and the pressure at the "–" port when using probe model 24-7266.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen (Model 125)
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.4 Draft Zero Screen (Model 105/125)*

The Draft Zero Screen allows the user to manually zero the draft channel when the pressure reading is anything other than zero when measuring ambient room pressure. To zero the draft channel, remove all tubing from the analyzer's "+" and "–" ports and press the **ENTER** button.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Zeros the draft channel, and returns to the screen containing the draft reading.
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.5 Fuel Screen (Model 110/120/125)*

The Fuel Screen is displayed after warm-up, and is where an operator chooses which fuel is to be used by the analyzer to calculate combustion efficiency. Pressing the ▲ or ▼ button scrolls the display through the fuel codes. Pressing **ENTER** selects the displayed fuel and places the analyzer into its Run Mode. Note that the fuel code will be displayed in the top right corner of all screens while in the Run Mode.

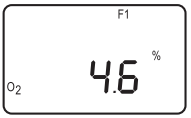
**Fuel Codes:**

| | |
|---|---|
| F1 = Natural Gas | F3 = LPG |
| F2 = Oil #2 | F4 = Kerosene |

**Front Panel Button Functions:**

- ▲ – Displays next fuel code
- ▼ – Displays previous fuel code
- **ENTER** – Go to Run Mode (refer to Section 4.12)
- **HOLD** – No effect
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.6 $O_2$ Screen (Model 110)*

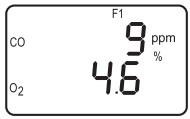



The $O_2$ Screen shows the measured percentage of oxygen present in the flue-gas stream.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## 4.13.7 CO & $O_2$ Screen *(Model 120/125)*



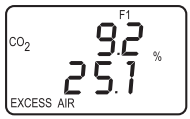

The CO reading is a measurement of how much carbon monoxide in ppm is present in the flue-gas stream. Note, however, that the amount of CO displayed may be diluted by secondary air (refer to Section 4.13.12 CO Air Free Screen).

The $O_2$ reading is the measured percentage of oxygen present in the flue-gas stream.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## 4.13.8 $CO_2$ & Excess Air Screen *(Model 110/120/125)*



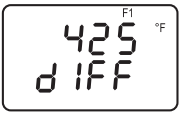

The $CO_2$ reading is a calculation of the percentage of carbon dioxide that is being produced by the combustion process.

Excess Air is a calculation of the percentage of extra air that was available in the combustion chamber above the theoretical amount needed for perfect combustion.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.9 Temperature Differential Screen (Model 125)*

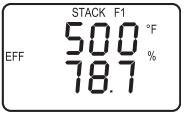



The Temperature Differential reading is the measured difference between the temperatures being measured by the T-STACK and T-AIR thermocouples.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.10 Stack Temperature & Efficiency Screen (Model 110/120/125)*



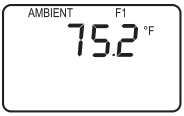

The STACK reading is the temperature measured at the tip of the probe.

The EFF (Efficiency) reading is a calculation of what percentage of energy present in the fuel was converted into usable heat.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## 4.13.11 Ambient Air Temperature Screen *(Model 110/120/125)*




The AMBIENT reading is the combustion-air temperature in either °F or °C that is used for efficiency calculations. This temperature is measured by either the T-AIR thermocouple on a continuous basis (Model 125), or by the T-STACK thermocouple during start-up (Model 110/120/125). If *neither* thermocouple is installed when the analyzer is turned ON, then this temperature reading comes from a temperature sensor located inside the analyzer. Refer to Section 4.2.1.

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## 4.13.12 CO Air Free Screen *(Model 120/125)*

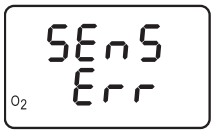
The CO AIR FREE reading is a calculation of the exact ppm concentration of carbon monoxide at the flame if oxygen were 0.0% in accordance with ANSI standard Z21.1.

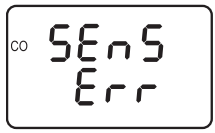
$$CO_{\text{Air Free}} = \frac{CO \times 20.9}{20.9 - O_2}$$

**Front Panel Button Functions:**

- ▲ – Displays next screen (refer to Section 4.12)
- ▼ – Displays previous screen (refer to Section 4.12)
- **HOLD** – Freezes display (press **ENTER** to unfreeze)
- **ENTER** – Hold for 2 seconds to display Fuel Screen
- **LIGHT** – Toggles backlight ON/OFF
- **I/O** – Turns analyzer OFF (5 second delay)

## *4.13.13 Sensor Error Screen (Model 100/105/110/120/125)*




An $O_2$ sensor error is displayed if the analyzer determines during the warm-up cycle that the oxygen sensor's output is too low for it to be usable. However, in the extreme condition when the $O_2$ sensor has *no output*, a sensor error will not occur. Instead, the $O_2$ reading will be 0.0 as displayed in the $O_2$ Screen or the CO & $O_2$ Screen.

> **Tip:** *To avoid $O_2$ errors from occurring, consider replacing the $O_2$ sensor when its output level drop below 100 as displayed during warm-up (refer to Section 4.13.1).*

When the CO channel is set up for Auto Zero (refer to Section 3.5.3), a CO sensor error will occur if the detected carbon monoxide level is above 50 ppm during the warm-up cycle. Note that if the CO channel is set up for manual calibration, the analyzer does not auto-zero the CO sensor during warm-up, and thus does not generate a CO sensor error when the analyzer is turned ON in an atmosphere containing a high background level of CO.

Do the following before replacing a suspected spent or defective sensor:

1. Turn OFF the analyzer and turn it back ON in an area of fresh air (containing 20.9% $O_2$ and no CO).

2. Perform the Oxygen Sensor Zero procedure (Section 5.5) and, if applicable, the CO Sensor Zero & Calibration procedure (Section 5.6).

3. If Steps 1 & 2 do not eliminate the error condition, replace sensor(s) (refer to Sections 5.9 or 5.10).

## Notes:

# 5.0 CALIBRATION & MAINTENANCE

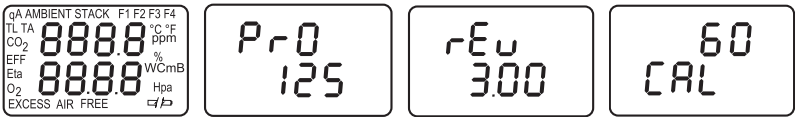
**Important:** *Fresh batteries should be installed, and the unit allowed to stabilize at room temperature for at least two hours before proceeding with calibration. To maintain accuracy as listed in the Technical Characteristics Section of this manual, the standards used must be at least four times as accurate as the stated accuracy of the Fyrite Pro.*

## 5.1 Entering the Calibration Mode and Testing the Display Segments

1. With the analyzer turned OFF, place the unit in fresh, ambient air; then press and hold down the **ENTER** button.

2. Press the **I/O** button and release it. Observe that all LCD segments are turned ON.

3. Release the **ENTER** button. Observe the unit's model number and software version are displayed. The word "CAL" is then displayed while the unit warms up counts down from 60 seconds.




At the end of 60 seconds, the first calibration screen is displayed.

**Note:** *The order in which the calibration screens are displayed depends on whether the CO channel is set up for automatic or manual zero (Section 3.5.3).*

**Calibration Screen Display Order**

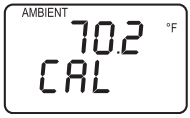
**CO Auto Zero:** Ambient, TA, Stack, $O_2$, CO, Pressure
**CO Manual Zero:** CO, Pressure, Ambient, TA, Stack, $O_2$

## 5.2 Ambient Temperature Calibration (Model 110/120/125)

**Material Required:** Calibrated Thermometer

**Procedure:**

1. Enter the Calibration Mode as described in Section 5.1. Observe that "AMBIENT" will appear at the top of the display; if not, repeatedly press **ENTER** until "AMBIENT" is displayed.




2. Use the ▲ and ▼ buttons to set the displayed value to match the reading of a calibrated thermometer at room temperature.

3. Press **ENTER** to store the displayed value and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store the displayed value and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

## 5.3 Combustion Air Thermocouple Calibration (Model 125)

**Material Required:** Thermocouple Simulator

**Procedure:**

1. Attach the thermocouple simulator to the Combustion Air Thermocouple connector on the analyzer (T-AIR, see Figure 3-2).

2. Enter the Calibration Mode as described in Section 5.1. Then repeatedly press the **ENTER** button until "TA" appears at the top of the display.

3. Set the simulator to 32.0 °F (0 °C); then use the ▲ and ▼ buttons to set the displayed value to match the simulator's value.

4. Set the simulator to 212.0 °F (100 °C); then use the ▲ and ▼ buttons to adjust the displayed value to match simulator's value.

5. Repeat Steps 3 and 4 as necessary until the unit is reading correctly at both temperatures.

6. Press **ENTER** to store these calibration values and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store these calibration values and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

7. Remove thermocouple simulator from analyzer.

## 5.4 Stack Thermocouple Calibration
### (Model 110/120/125)

**Material Required:** Thermocouple Simulator

**Procedure:**

1. Attach the thermocouple simulator to the Stack Thermocouple connector on the analyzer (T-STACK, see Figure 3-2).

2. Enter the Calibration Mode as described in Section 5.1. Then repeatedly press the **ENTER** button until "STACK" appears at the top of the display.

3. Set the simulator to 32 °F (0 °C); then use the ▲ and ▼ buttons to set the displayed value to match the simulator's value.

4. Set the simulator to 572 °F (300 °C); then use the ▲ and ▼ buttons to adjust the displayed value to match simulator's value.

5. Repeat Steps 3 and 4 as necessary until the unit is reading correctly at both temperatures.

6. Press **ENTER** to store these calibration values and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store these calibration values and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

7. Remove thermocouple simulator from analyzer.

## 5.5 Oxygen Sensor Zero (Model 110/120/125)

**Material Required:**
- Cylinder of 100% Nitrogen, P/N 9550-0049
- Calibration Kit, P/N 24-7059

**Procedure:**

1. With the analyzer sampling fresh air, enter the Calibration Mode as described in Section 5.1. Then repeatedly press the **ENTER** button until "$O_2$" appears in the lower-left side of the display.

2. Allow pump to run and sample fresh air for at least 1 minute.

3. Use the ▲ and ▼ buttons to set the display to 20.9%.

4. Set up the Calibration Kit with 100% $N_2$ as described in the instructions supplied with the kit.

5. Connect the tubing of the Calibration Kit to the GAS inlet of the analyzer; then adjust the regulator for approximately 2 SCFH of excess flow (see Figure 5-1).

6. After the analyzer has stabilized (2 to 3 minutes,) use the ▲ and ▼ buttons to set the displayed value to 0.0%.

7. Disconnect tubing from analyzer and turn off gas flow.

8. Allow the analyzer's pump to run until the $O_2$ reading returns to 20.9. If necessary, use the ▲ and ▼ buttons to readjust the reading to 20.9. Repeat Steps 3 thru 7 to verify the zero adjustment.

9. Press **ENTER** to store the new calibration values and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store the new calibration values and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

## 5.6 CO Sensor Zero & Calibration
**(Model 100/105/120/125)**

**Material Required:**
- Cylinder of 100 ppm (P/N 51-1994) or 500 ppm (P/N 24-0492) CO calibration gas
- Calibration Kit, P/N 24-7059

To improve the accuracy of the CO reading, we suggest that if the analyzer will be primarily used for flue gas testing, then calibrate using 500 ppm CO. If the analyzer, however, will be primarily used for ambient testing, then calibrate using 100 ppm CO.

**Procedure:**

1. With the analyzer sampling fresh air, enter the Calibration Mode as described in Section 5.1. Then repeatedly press the **ENTER** button until "CO" appears in the upper-left side of the display.

2. Allow the pump to run and sample fresh air for at least 1 minute.
3. Use the ▲ and ▼ buttons to set the displayed value to 0 ppm.
4. Do one of the following:
   a. End this procedure and save the new zero value by holding down the **ENTER** button for 2 seconds; after which, the analyzer enters its Run Mode.
   b. Continue with Step 5 to span the CO sensor on a known concentration of carbon monoxide.
5. Set up the Calibration Kit with 100 or 500 ppm CO as described in the instructions supplied with the kit.

6. Connect the tubing of the Calibration Kit to the GAS inlet of the analyzer. Note that the gas fitting (Item 6) is only required on Fyrite Pro Models 105 and 125.

7. Adjust the regulator for approximately 2 SCFH of excess flow (see Figure 5.1).

8. After the analyzer has stabilized (2 to 3 minutes), use the ▲ and ▼ buttons to set the displayed value to match the CO concentration stamped on the gas cylinder.

9. Press **ENTER** to store the new calibration values and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store the new calibration values and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

10. Disconnect tubing from analyzer and turn off gas flow.

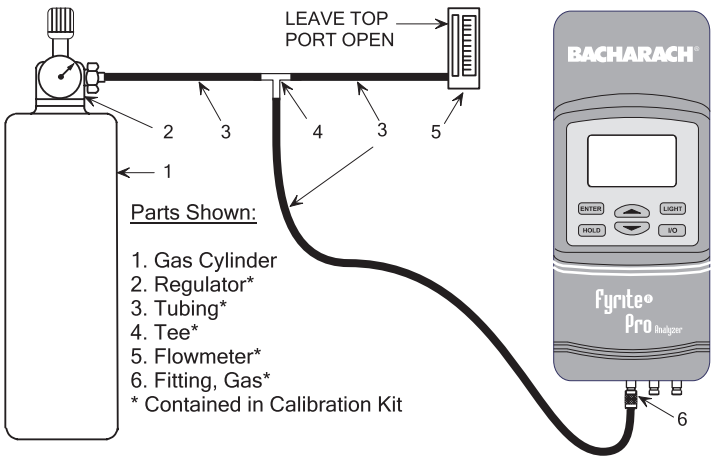



***Figure 5-1. Calibration Kit Hookup***

# 5.7 Draft Calibration (Model 105/125)

**Material Required:**
- Bellows
- Micromanometer
  Range: ±8 in. $H_2O$ column (±20 mb)
  Accuracy: ±0.01 in. $H_2O$ column (±20 mb)

**Procedure:**

1. Set the draft units to "WC" per Section 3.5.4.
2. Enter the Calibrate Mode per Section 5.1, and then press the **ENTER** button until "WC" is displayed.

3. If necessary, zero the draft channel by using the ▲ and ▼ buttons to adjust the reading to 0.00 ±0.02.
4. Set up the analyzer and its test equipment per Figure 5-2.
5. Use the bellows to apply a positive pressure of 4.00 in. $H_2O$, and then use the ▲ and ▼ buttons to adjust the displayed value to match the reading on the manometer.
6. Remove pressure and repeat Steps 3 thru 5 until the desired readings are obtained.
7. Press **ENTER** to store the new calibration values and move to the next calibration screen, or hold down **ENTER** for 2 seconds to store the new calibration values and enter the Run Mode, or press the **I/O** button to exit the Calibration Mode and turn OFF the analyzer without saving the changes.

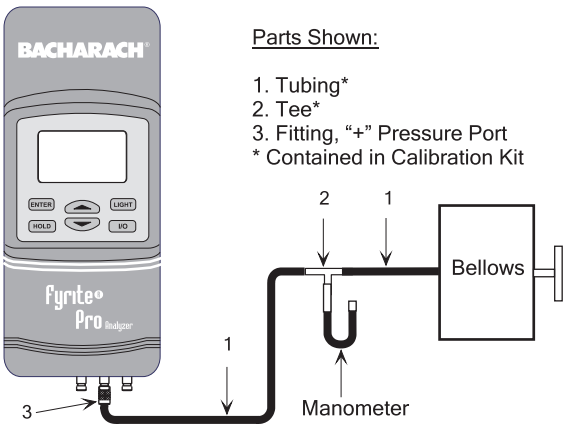



***Figure 5-2. Draft Calibration Equipment***

# 5.8 Water Trap / Filter Maintenance

The Water Trap / Filter Assembly removes water condensate from the gas sample, and also prevents soot from contaminating the internal components of the analyzer.

## Drain the water condensate after every test.

**Procedure:**

1. Disassemble the trap (see Figure 5-3).
2. Pour out all water condensate; then reassemble the trap.

## Replace the Filter Element when dirty.

**Material Required:**
- Filter Element, P/N 07-1644
- Small Flat Blade Screwdriver

**Procedure:**

1. Disassemble the trap (see Figure 5-3).
2. Remove and discard old filter.
3. Install new filter and reassemble trap.

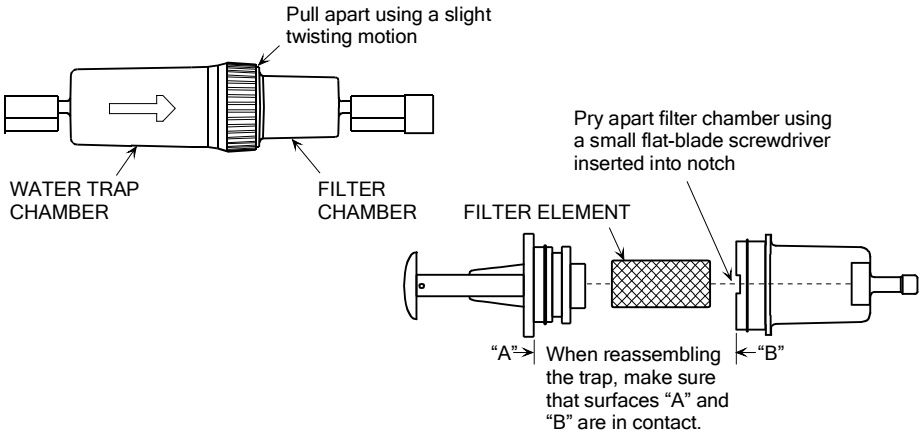



***Figure 5-3. Water Trap / Filter Assembly***

# 5.9 $O_2$ Sensor Replacement (Model 110/120/125)

Be sure to perform all of the checks listed in Section 4.13.13 to ensure that the $O_2$ sensor needs to be replaced.

**Material Required:**
- Oxygen Sensor, P/N 24-8106
- #1 Phillips Screwdriver

**Procedure:**

1. Disassemble the analyzer as follows:
   a. Remove the battery cover and the batteries, uncovering one of the cover hold-down screws.
   b. Remove and set aside all four cover hold-down screws.
   c. With the analyzer on its back, remove the front cover, laying it face down to the left of the body.
   d. Carefully remove the circuit board, slipping off the battery connector on top, and then laying the circuit board face down in the top cover.
2. Slip off the oxygen sensor's electrical connector from the circuit board. Then push down; twist counterclockwise; then pull the oxygen sensor out of its socket (see Figure 5-4).

   **Tip:** *To obtain a better grip on the oxygen sensor, it may be necessary to remove the screw that secures the sensor socket to the case.*
3. Using the old sensor as a guide, remove the paper backing from the new sensor gasket contained in the replacement kit, and adhere it to the new sensor.
4. Dispose of the old oxygen sensor in a proper manner (see the instruction sheet that comes with the new sensor).
5. Mount the new oxygen sensor in its socket. If the sensor socket was removed in Step 2, re-attach it to the case.
6. Plug the oxygen sensor's electrical connector into the printed circuit board (observe polarity, see Figure 5-5), and then reassemble the analyzer.

   **Note:** *The sensor may take several hours to stabilize after being connected to the printed circuit board.*

# 5.10 CO Sensor Replacement
**(Model 100/105/120/125)**

Be sure to perform all of the checks listed in Section 4.13.13 to ensure that the CO sensor needs to be replaced.

**Material Required:**
- CO Sensor, P/N 24-7265
- CO Sensor Gasket, P/N 24-1112
- #1 Phillips Screwdriver

**Procedure:**

1. Disassemble the analyzer as follows:
   a. Remove the battery cover and the batteries, uncovering one of the cover hold-down screws.
   b. Remove and set aside all four cover hold-down screws.
   c. With the analyzer on its back, remove the front cover, laying it face down to the left of the body.
   d. Carefully remove the circuit board, slipping off the battery connector on top, and then laying the circuit board face down in the top cover.
2. Gently pull CO sensor out of its socket (see Figure 5-5).
3. Properly dispose of the old CO sensor (see the instruction sheet that comes with the new sensor).
4. It is recommended that the CO sensor gasket be replaced at the same time as the sensor. Remove the old gasket and discard. Remove the paper backing from the new gasket and adhere it to the case in the same position as the old one.

   **Important:** *Ensure that the new gasket does not restrict the inlet and exhaust holes in the case.*
5. Plug the new CO sensor into its socket.
6. Reassemble the analyzer.

# 5.11 Pump Assembly Replacement

**Material Required:**
- Pump, P/N 24-3020
- #1 Phillips Screwdriver

**Procedure:**

1. Disassemble the analyzer as follows:
   a. Remove the battery cover and the batteries, uncovering one of the cover hold-down screws.
   b. Remove and set aside all four cover hold-down screws.
   c. With the analyzer on its back, remove the front cover, laying it face down to the left of the body.
   d. Carefully remove the circuit board, slipping off the battery connector on top, and then laying the circuit board face down in the top cover.
2. Slip off the pump motor's electrical connector from the circuit board.
3. Unscrew the pump's hold down clamp and remove it from the pump (see Figure 5-4). Make note of how the pump wiring is routed.
4. Make note of how the tubing connects to the pump; then carefully remove tubing from pump.
5. Remove the old pump and discard.
6. Install the new pump and reinstall the tubing, taking care not to pinch or crimp the tubing. Also be sure pump wiring is routed as was noted in Step 3.
7. Reassemble the analyzer.

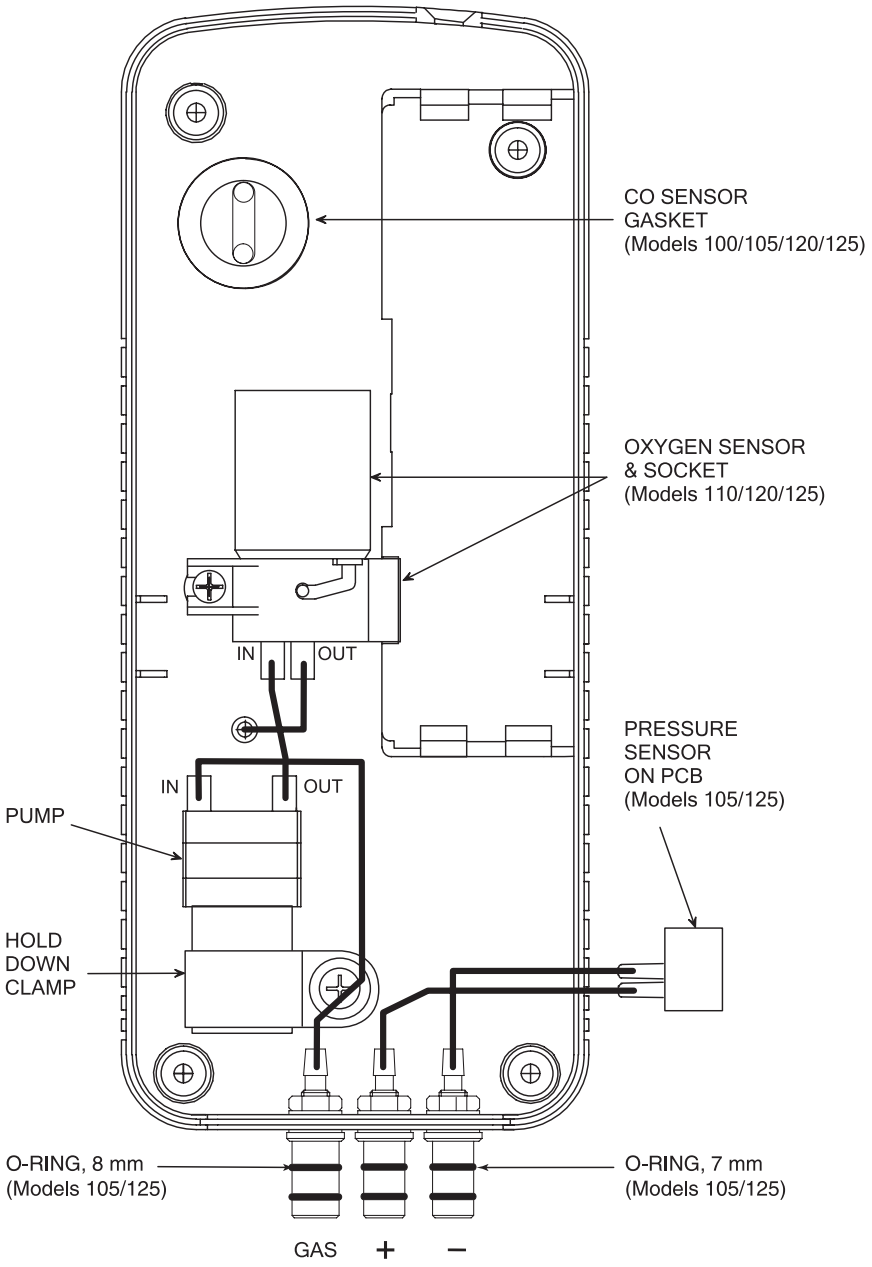



***Figure 5-4. Case Components & Plumbing Schematic***

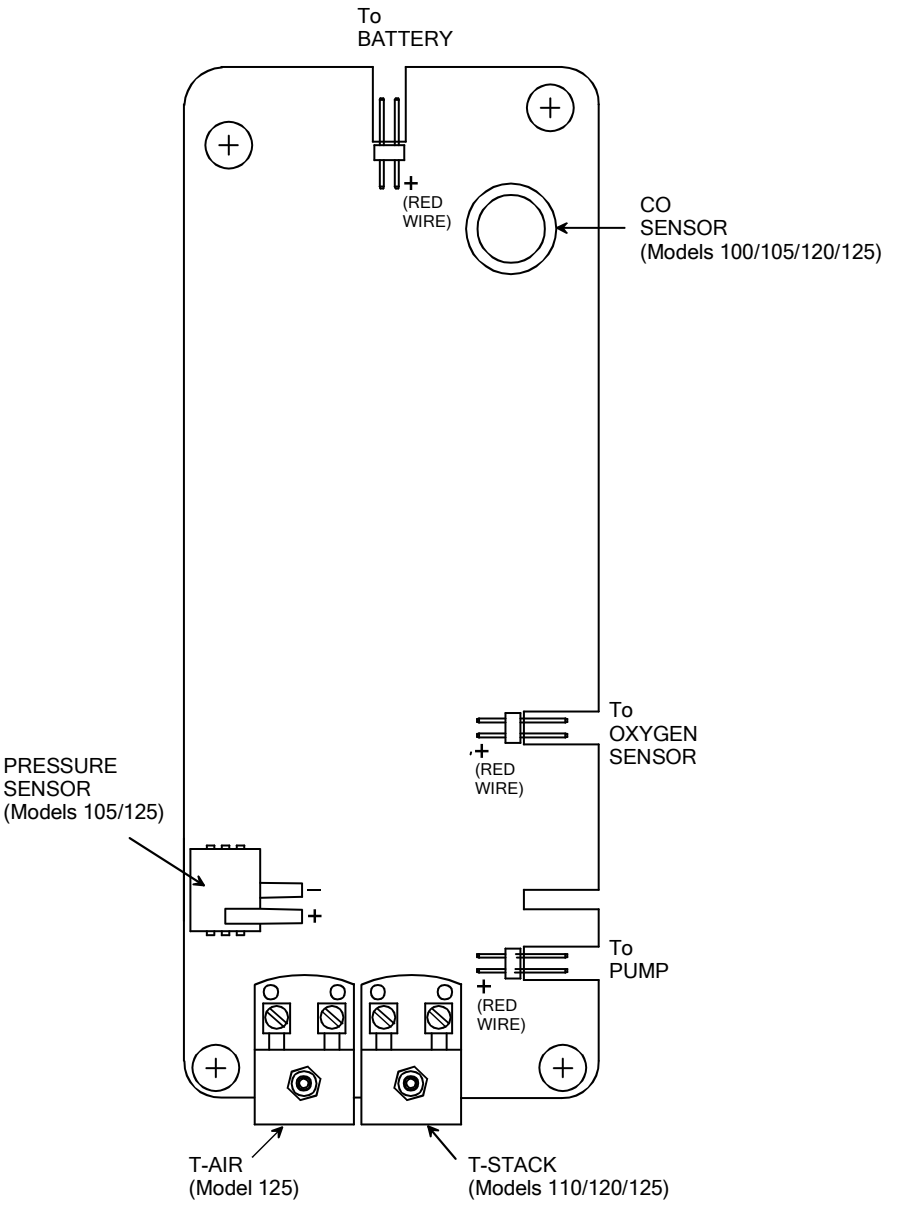



***Figure 5-5. PCB Components***

## Notes:

# 6.0 PARTS & SERVICE

## 6.1 Replacement Parts

| Description | Part No. |
|---|---|
| Carbon Monoxide Sensor | 24-7265 |
| Carbon Monoxide Sensor Gasket | 24-1112 |
| Oxygen Sensor w/ Gasket | 24-8106 |
| Oxygen Sensor Gasket | 24-1111 |
| O-ring, Gas and Draft Connector (Model 105/125): | |
| 8 mm OD, Gas Connector | 105-5102 |
| 7 mm OD, Pressure Connectors | 105-5103 |
| Pump Assembly | 24-3020 |
| Thermocouple Replacement Kit (for 12" Probe 24-3004) | 24-8414 |
| Water Trap / Filter Assembly, Complete | 19-3265 |
| Water Trap / Filter Assembly, Filter Element (pack of 3) | 07-1644 |

## 6.2 Accessories

### 6.2.1 Standard Accessories

| | |
|---|---|
| Battery, “AA” Alkaline | 204-0004 |
| Carrying Case | 24-0865 |
| Instruction Manual | 24-9395 |
| Probe (12"), Hose, and Water Trap / Filter Assembly: | |
| Model 100 | 19-7110 |
| Model 110/120 | 19-7111 |
| Model 105/125 | 24-3004 |
| Quick Reference Guide | 24-9396 |

## 6.2.2 Optional Accessories

AC Adapter (Battery Eliminator).....24-1254
Calibration Kit .....24-7059
Calibration Gas Cylinder:
    100 ppm CO..... 51-1994
    500 ppm CO ..... 24-0492
    100% Nitrogen ..... 9550-0049
Differential Pressure Hose Assembly, 6 ft (Model 105/125) ..... 24-1103
Printer:
    IrDA w/ rechargeable batteries (includes 120 VAC charger)* .....24-1229
    IrDA w/ disposable batteries .....24-1400
Printer Paper:
    1 Roll ..... 06-8733
    5 Roll Pack .....24-1310
Probe Stop w/ Thumbscrew*.....19-3037
Protective Rubber Boot w/ Magnets* .....24-1127
Soft Carrying Case .....24-1267
Thermocouple, Second Channel (Model 125):
    1 inch..... 104-1798
    10 feet..... 104-1797
True Spot Smoke Test Set*.....21-7006
  Filter Paper, True Spot (40 strips) .....21-0019

* Depending on the analyzer's model number, this optional accessory may be supplied as a standard item.

# 6.3 Service Centers

Replacement parts and service can be obtained by contacting one of the following Bacharach Service Centers:

## United States

### California

7281 Garden Grove Blvd.,
Suite H
Garden Grove, CA 92841
Phone: 714-895-0050
Fax: 714-895-7950
Email: calservice@bacharach-inc.com

### New Jersey

7300 Industrial Park
Rte. 130, Bldg. 22
Pennsauken, NJ 08110
Phone: 856-665-6176
Fax: 856-665-6661
Email: njservice@bacharach-inc.com

### Pennsylvania

621 Hunt Valley Circle
New Kensington, PA 15068
Phone: 724-334-5051
Fax: 724-334-5723
Email: help@bacharach-inc.com

## Canada

Bacharach of Canada, Inc.
250 Shields Court Unit #3
Markham, Ontario L3R 9W7 Canada
Phone: 905-470-8985
Fax: 905-470-8963
Email: bachcan@idirect.com

## México

Bacharach de México
Playa Regatas No. 473 Tercer Piso
Col. Militar Marte
Delegación Iztacalco, 08830
México D.F. México
Phones: +52-555-634-7740
+52-555-634-7741
FAX: +52-555-634-7738
Email: bacharach@prodigy.net.mx

## Europe

**European Headquarters**
Bacharach Instruments
Sovereign House, Queensway
Royal Leamington Spa
Warwickshire CV31 3JR
United Kingdom
Phone: +44-1926-338111
Fax: +44-1926-338110
Email: sales@bacharach-europe.com

**Sales / Service Center - Denmark**
Bacharach Instruments Int'l
P.O. Box 44
39 Lindegade
DK 6070 Christiansfeld Denmark
Phone: +45-74-563171
Fax: +45-74-563178
Email: mail@bacharach.dk

Headquarters:
621 Hunt Valley Circle, New Kensington, PA 15068
Ph: 724-334-5000 • Fax: 724-334-5001 • Toll Free: 800-736-4666
Website: www.bacharach-inc.com • E-mail: help@bacharach-inc.com

Printed in U.S.A.